

TOSHIBA CMOS Digital Integrated Circuit Silicon Monolithic

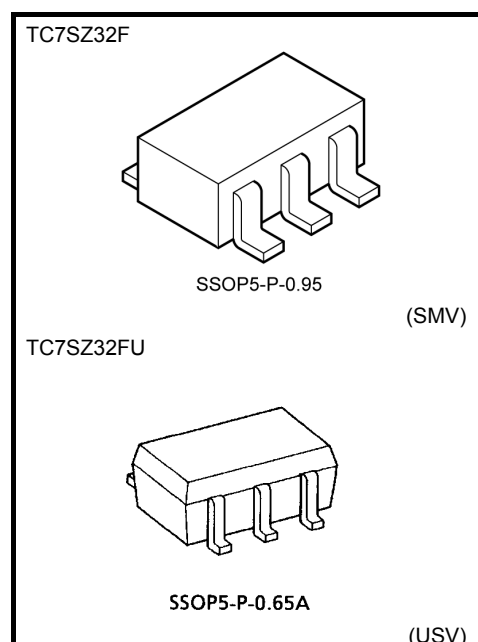
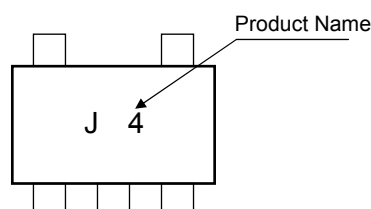
# TC7SZ32F, TC7SZ32FU

## 2-Input OR Gate

### Features

- High output current :  $\pm 24$  mA (min) at  $V_{CC} = 3$  V
- Super high speed operation :  $t_{pd} = 2.4$  ns (typ.)  
at  $V_{CC} = 5$  V, 50 pF
- Operating voltage range :  $V_{CC} = 1.8$  to 5.5 V
- 5.5-V tolerant inputs
- 5.5-V power down protection output
- Matches the performance of TC74LCX series when operated at 3.3-V  $V_{CC}$

### Marking



Weight:  
SSOP5-P-0.95 : 0.016 g (typ.)  
SSOP5-P-0.65A : 0.006 g (typ.)

### Absolute Maximum Ratings ( $T_a = 25^\circ\text{C}$ )

Characteristics	Symbol	Rating	Unit
Supply voltage	$V_{CC}$	-0.5 to 6	V
DC input voltage	$V_{IN}$	-0.5 to 6	V
DC output voltage	$V_{OUT}$	-0.5 to 6 (Note 1)	V
		-0.5 to $V_{CC} + 0.5$ (Note 2)	
Input diode current	$I_{IK}$	-20	mA
Output diode current	$I_{OK}$	-20 (Note 3)	mA
DC output current	$I_{OUT}$	$\pm 50$	mA
DC $V_{CC}$ /ground current	$I_{CC}$	$\pm 50$	mA
Power dissipation	$P_D$	200	mW
Storage temperature	$T_{stg}$	-65 to 150	$^\circ\text{C}$
Lead temperature (10 s)	$T_L$	260	$^\circ\text{C}$

Note: Using continuously under heavy loads (e.g. the application of high temperature/current/voltage and the significant change in temperature, etc.) may cause this product to decrease in the reliability significantly even if the operating conditions (i.e. operating temperature/current/voltage, etc.) are within the absolute maximum ratings and the operating ranges.

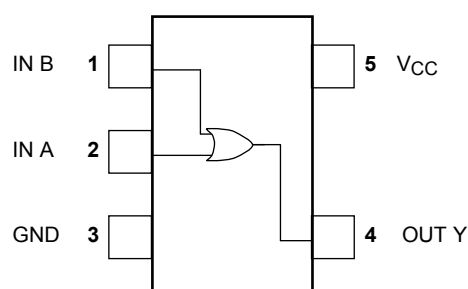
Please design the appropriate reliability upon reviewing the Toshiba Semiconductor Reliability Handbook ("Handling Precautions"/"Derating Concept and Methods") and individual reliability data (i.e. reliability test report and estimated failure rate, etc).

Note 1:  $V_{CC} = 0$  V

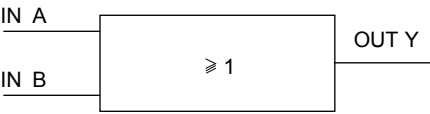
Note 2: High or Low State. Do not exceed  $I_{OUT}$  of absolute maximum ratings.

Note 3:  $V_{OUT} < GND$

### Pin Assignment (top view)



IEC Logic Symbol



Truth Table

A	B	Y
L	L	L
L	H	H
H	L	H
H	H	H

Operating Ranges

Characteristics	Symbol	Rating	Unit
Supply voltage	V <sub>CC</sub>	1.8 to 5.5	V
		1.5 to 5.5 (Note 4)	
Input voltage	V <sub>IN</sub>	0 to 5.5	V
Output voltage	V <sub>OUT</sub>	0 to 5.5 (Note 5)	V
		0 to V <sub>CC</sub> (Note 6)	
Operating temperature	T <sub>opr</sub>	−40 to 85	°C
Input rise and fall time	dt/dv	0 to 20 (V <sub>CC</sub> = 1.8 V, 2.5 V ± 0.2 V)	ns/V
		0 to 10 (V <sub>CC</sub> = 3.3 V ± 0.3 V)	
		0 to 5 (V <sub>CC</sub> = 5.0 V ± 0.5 V)	

Note 4: Data retention only

Note 5: V<sub>CC</sub> = 0 V

Note 6: High or Low state

## Electrical Characteristics

### DC Characteristics

Characteristics	Symbol	Test Condition		Ta = 25°C			Ta = -40 to 85°C		Unit		
				V <sub>CC</sub> (V)	Min	Typ.	Max	Min		Max	
High-level input voltage	V <sub>IH</sub>	—		1.8	V <sub>CC</sub> × 0.88	—	—	V <sub>CC</sub> × 0.88	V		
				2.3 to 5.5	V <sub>CC</sub> × 0.75	—	—	V <sub>CC</sub> × 0.75		—	
Low-level input voltage	V <sub>IL</sub>	—		1.8	—	—	V <sub>CC</sub> × 0.12	V <sub>CC</sub> × 0.12	V		
				2.3 to 5.5	—	—	V <sub>CC</sub> × 0.25	—		V <sub>CC</sub> × 0.25	
High-level output voltage	V <sub>OH</sub>	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OH</sub> = -100 μA	1.8	1.7	1.8	—	1.7	V		
				2.3	2.2	2.3	—	2.2		—	
				3.0	2.9	3.0	—	2.9		—	
				4.5	4.4	4.5	—	4.4		—	
			I <sub>OH</sub> = -8 mA	2.3	1.9	2.15	—	1.9		—	
				I <sub>OH</sub> = -16 mA	3.0	2.4	2.8	—		2.4	—
				I <sub>OH</sub> = -24 mA	3.0	2.3	2.68	—		2.3	—
				I <sub>OH</sub> = -32 mA	4.5	3.8	4.2	—		3.8	—
Low-level output voltage	V <sub>OL</sub>	V <sub>IN</sub> = V <sub>IL</sub>	I <sub>OL</sub> = 100 μA	1.8	—	0	0.1	—	V		
				2.3	—	0	0.1	—		0.1	
				3.0	—	0	0.1	—		0.1	
				4.5	—	0	0.1	—		0.1	
			I <sub>OL</sub> = 8 mA	2.3	—	0.1	0.3	—		0.3	
				I <sub>OL</sub> = 16 mA	3.0	—	0.15	0.4		—	0.4
				I <sub>OL</sub> = 24 mA	3.0	—	0.22	0.55		—	0.55
				I <sub>OL</sub> = 32 mA	4.5	—	0.22	0.55		—	0.55
Input leakage current	I <sub>IN</sub>	V <sub>IN</sub> = 5.5 V or GND	0 to 5.5	—	—	±1	—	±10	μA		
Power off leakage current	I <sub>OFF</sub>	V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V	0.0	—	—	1	—	10	μA		
Quiescent supply current	I <sub>CC</sub>	V <sub>IN</sub> = V <sub>CC</sub> or GND	5.5	—	—	2	—	20	μA		

AC Characteristics (unless otherwise specified, Input:  $t_r = t_f = 3 \text{ ns}$ )

Characteristics	Symbol	Test Condition	Ta = 25°C				Ta = −40 to 85°C		Unit
			VCC (V)	Min	Typ.	Max	Min	Max	
Propagation delay time	tpLH tpHL	CL = 15 pF, RL = 1 MΩ	1.8	2.0	4.6	10.0	2.0	10.5	ns
			2.5 ± 0.2	0.8	3.0	7.0	0.8	7.5	
			3.3 ± 0.3	0.5	2.4	4.7	0.5	5.0	
			5.0 ± 0.5	0.5	1.9	4.1	0.5	4.4	
		CL = 50 pF, RL = 500 Ω	3.3 ± 0.3	1.5	3.0	5.2	1.5	5.5	
			5.0 ± 0.5	0.8	2.4	4.5	0.8	4.8	
Input capacitance	CIN	—	0 to 5.5	—	4	—	—	pF	
Power dissipation capacitance	CPD	(Note 7)	3.3	—	20	—	—	—	pF
			5.5	—	26	—	—	—	

Note 7: C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load.

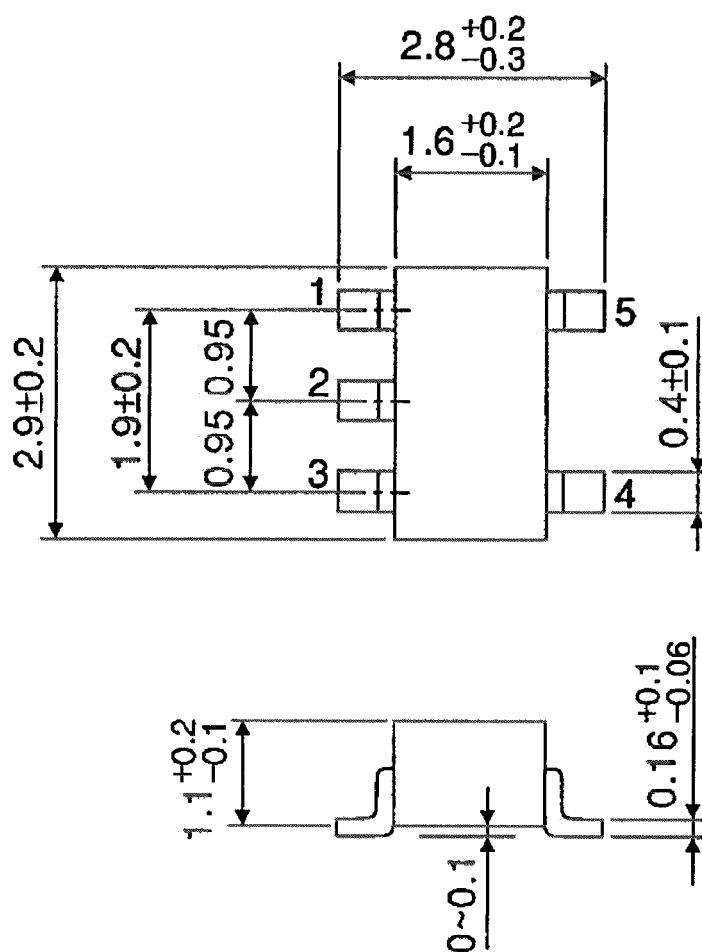
Average operating current can be obtained by the equation:

$$I_{CC(\text{opr.})} = C_{PD} \cdot V_{CC} \cdot f_{IN} + I_{CC}$$

## Package Dimensions

SSOP5-P-0.95

Unit : mm

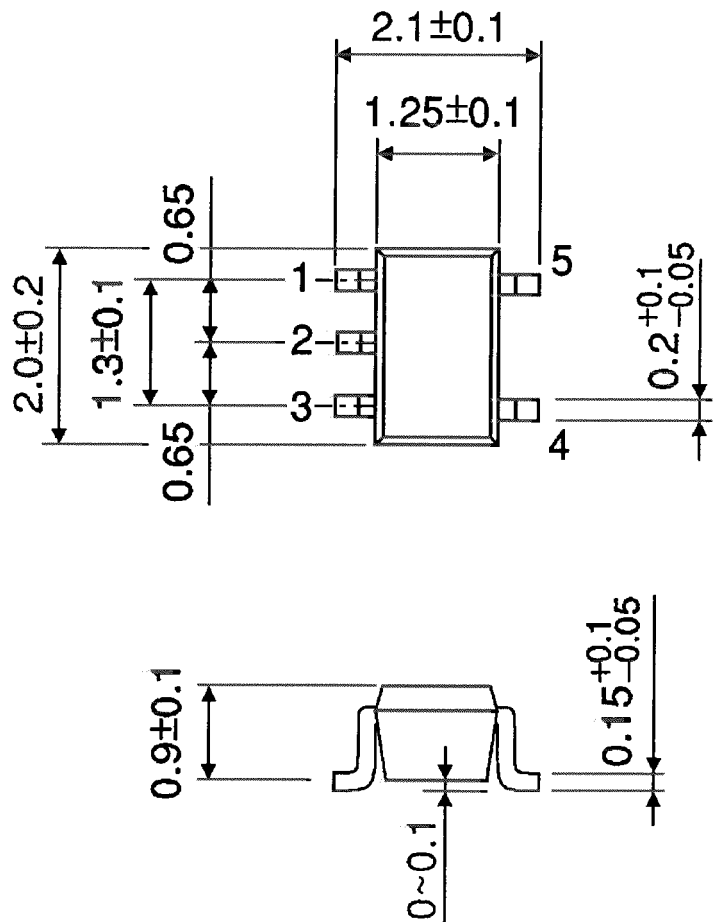


Weight: 0.016 g (typ.)

Package Dimensions

SSOP5-P-0.65A

Unit : mm



Weight: 0.006 g (typ.)

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